USER MANUAL

Pushbutton Transmitter Device
PTM 210 / PTM 215
PTM 210U / PTM 210J

June 14, 2013

Patent protected:
US 6,747,573
US 7,019,241
Further patents pending

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Subject to modifications
PTM 210 / PTM 215 / PTM 210U / PTM 210J
User Manual
June 2013

REVISION HISTORY

The following major modifications and improvements have been made to the first version of this document:

No	Major Changes
1	Updated operating force to typ. 8 N
2	Merged PTM 210, PTM 215 and PTM 210U into one user manual
3	Added PTM 210J incl. radio certificate

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Important!

This information describes the type of component and shall not be considered as assured characteristics. No responsibility is assumed for possible omissions or inaccuracies. Circuitry and specifications are subject to change without notice. For the latest product specifications, refer to the EnOcean website: http://www.enocean.com.
As far as patents or other rights of third parties are concerned, liability is only assumed for devices, not for the described applications, processes and circuits.
EnOcean does not assume responsibility for use of devices described and limits its liability to the replacement of devices determined to be defective due to workmanship. Devices or systems containing RF components must meet the essential requirements of the local legal authorities.
The devices must not be used in any relation with equipment that supports, directly or indirectly, human health or life or with applications that can result in danger for people, animals or real value.
Components of the devices are considered and should be disposed of as hazardous waste. Local government regulations are to be observed.
Packing: Please use the recycling operators known to you. By agreement we will take packing material back if it is sorted. You must bear the costs of transport. For packing material that is returned to us unsorted or that we are not obliged to accept, we shall have to invoice you for any costs incurred.

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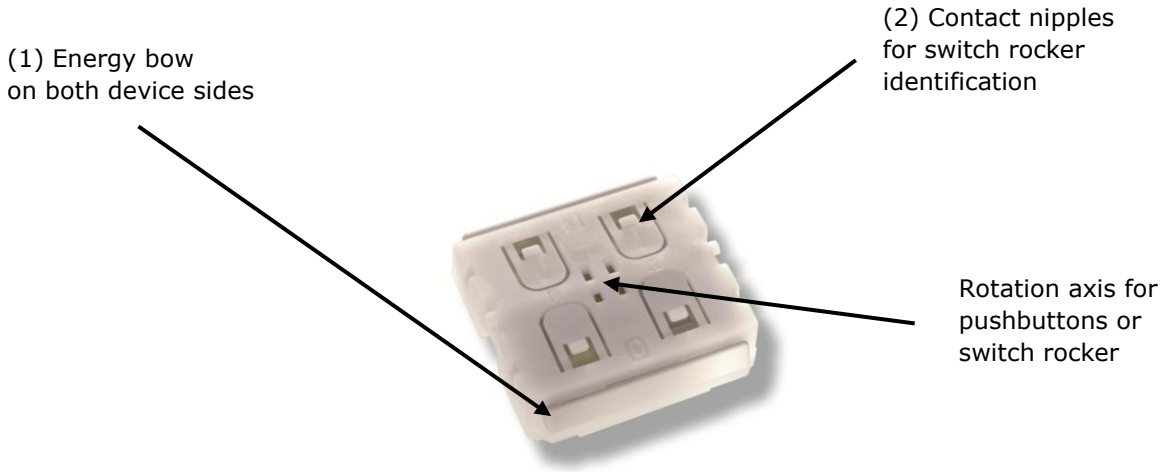
1 GENERAL DESCRIPTION

The radio transmitter device PTM 21x from EnOcean enables the implementation of wireless remote controls without batteries. Power is provided by a built-in electro-dynamic power generator. The PTM 21x device serves the 868 MHz, 902 MHz, and 928MHz radio interface protocol of EnOcean.



Electro-dynamic powered radio transmitter device PTM 21x

Following variants are available:

- PTM 210 868,300 MHz
- PTM 215 868,300 MHz with encryption
- PTM 210U 902.875 MHz
- PTM 210J 928.350 MHz

1.1 Basic Functionality

A common electro-dynamic energy transducer is actuated by a bow (1), which can be pushed from outside the device by an appropriate push button or switch rocker. When the energy bow is pushed down, electrical energy is created and an RF telegram is transmitted including a 32-bit device ID. Releasing the energy bow generates different telegram data, so every PTM telegram contains the information that the bow was pressed or released.

"Long" or "Short" push button operation (the time between pushing and releasing the pushbutton) can be easily detected by the receiver. By doing that, applications such as dimming control or blinds control including slat action are simple to implement.

In addition, the PTM telegram transmits the operating status of the contact nipples (2) when pressing the bow. This enables the identification of up to 2 appropriate switch rockers or up to 4 pushbuttons.

PTM 215 supports 2 operating modes. A normal mode and a secure mode with additional rolling code mechanism which allows preventing replay attacks in sensible applications.

1.2 Typical Applications

- Building installation
- Industrial automation
- Consumer electronics

Key applications are wall-mounted flat rocker switches with 1 or 2 rockers, as well as handheld remote controls with up to 4 single pushbuttons. Because the RF transmitters are self-powered (no batteries), maintenance-free RF systems are possible.

1.3 Technical Data

Power supply	power generation by rocker operating, electro-dynamic power generator
Antenna	internal PCB antenna
Frequency	PTM 210: 868.300 MHz (ASK)[1] PTM 215: 868.300 MHz (ASK)[1] PTM 210U: 902.875 MHz (FSK) PTM 210J: 928.350 MHz (FSK)
Data rate	125 kbps
Conducted output power	PTM 210 / PTM 215 / PTM 210U: +5dBm PTM 210J: 0dBm
Channels	2 with 4 action states each upper/lower pushbutton is pressed/released
EnOcean Equipment Profile supported	EEP F6-02-xx, F6-04-xx
Security mode	rolling code with AES128 (PTM 215 only)
Transmission range	PTM 210 / PTM 215 / PTM 210U: typ. 300 m free field, typ. 30 m indoor PTM 210J: typ. 200m free field, typ. 30m indoor
Device identifier	individual 32-bit ID (factory programmed)[2]

[1] According the international standard for energy harvesting wireless radio protocol for self-powered applications: ISO/IEC 14543-3-10

[2] PTM 210J: 48-bit ID possible, see 4.3

1.4 Mechanical Interface

Device dimensions (inclusive rotation axis and energy bow)	40.0 x 40.0 x 11.2 mm
Device weight	20 g ± 1 g
Energy bow travel / operating force	1.8 mm / typ. 8 N
*) at room temperature, only one energy bow may be actuated at the same time!	
Restoring force at energy bow	typ. 0.7 N to 4 N
For the correct function of the application, the specified minimal restoring force of 0.5 N must be considered!	
Number of operations at 25°C	typ. 100.000 actuations tested according to VDE 0632 / EN 60669
Cover material	Hostaform (POM)
Energy bow material	PBT (50% GV)

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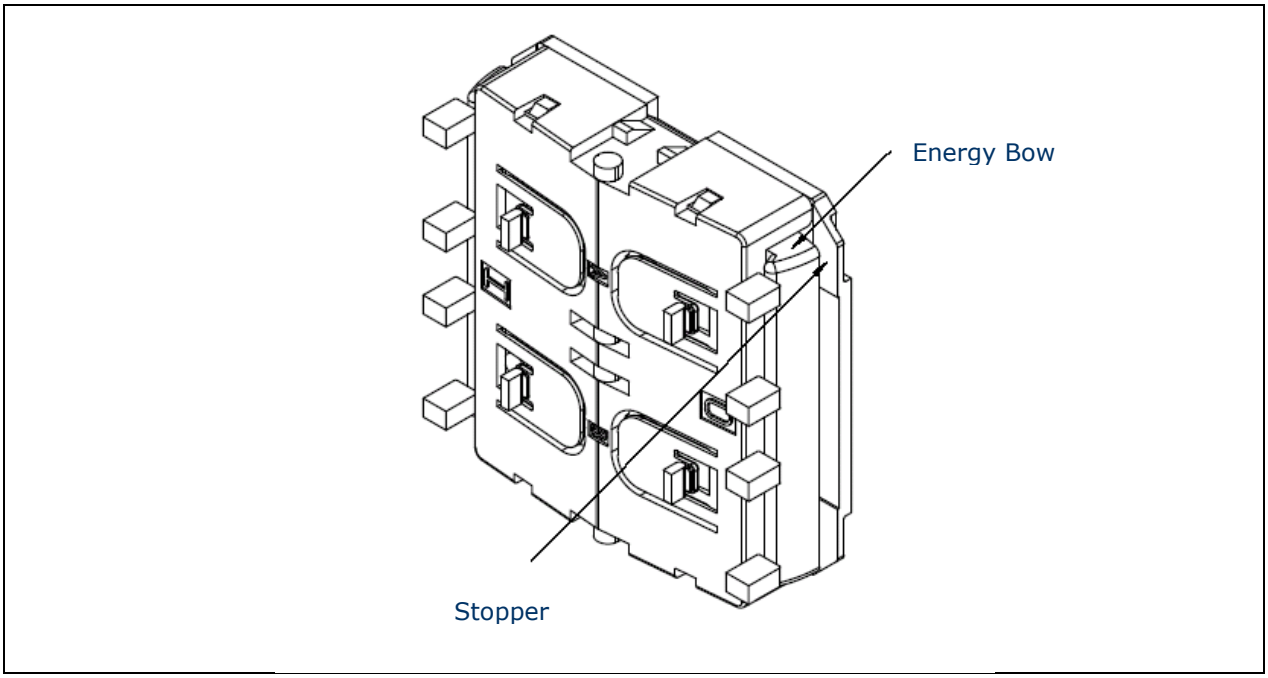
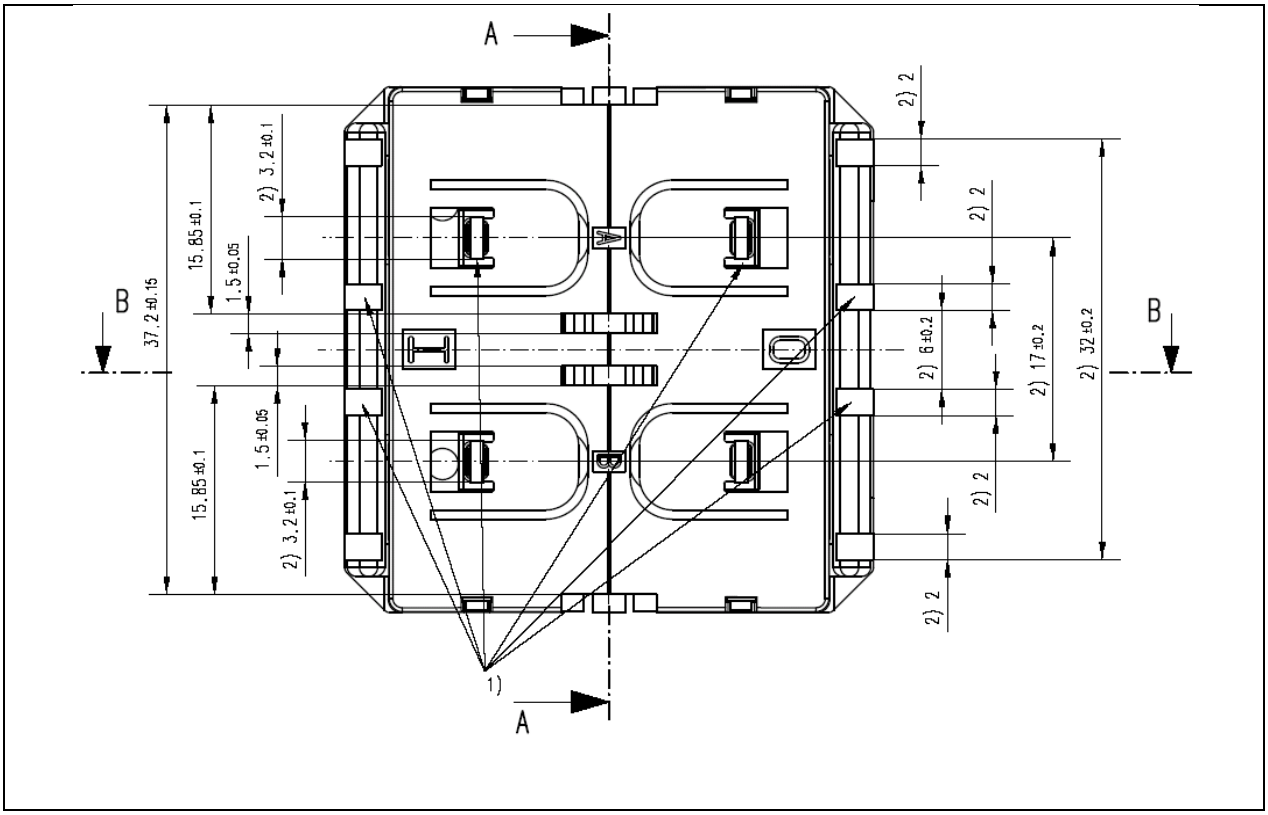


PTM 21x without antenna, tilted view (including rocker catwalks)



1) these catwalks are not needed when using one single rocker only 2) dimensions of rocker part

PTM 21x, top view (note cut A, B and C marking)

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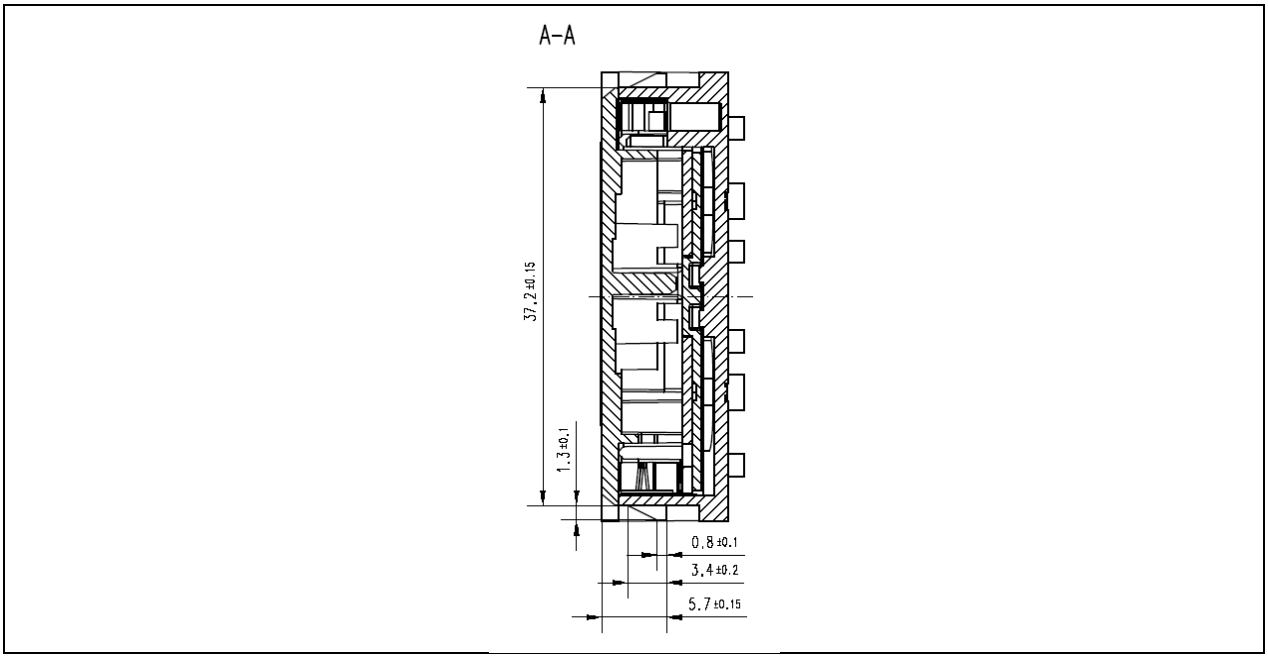
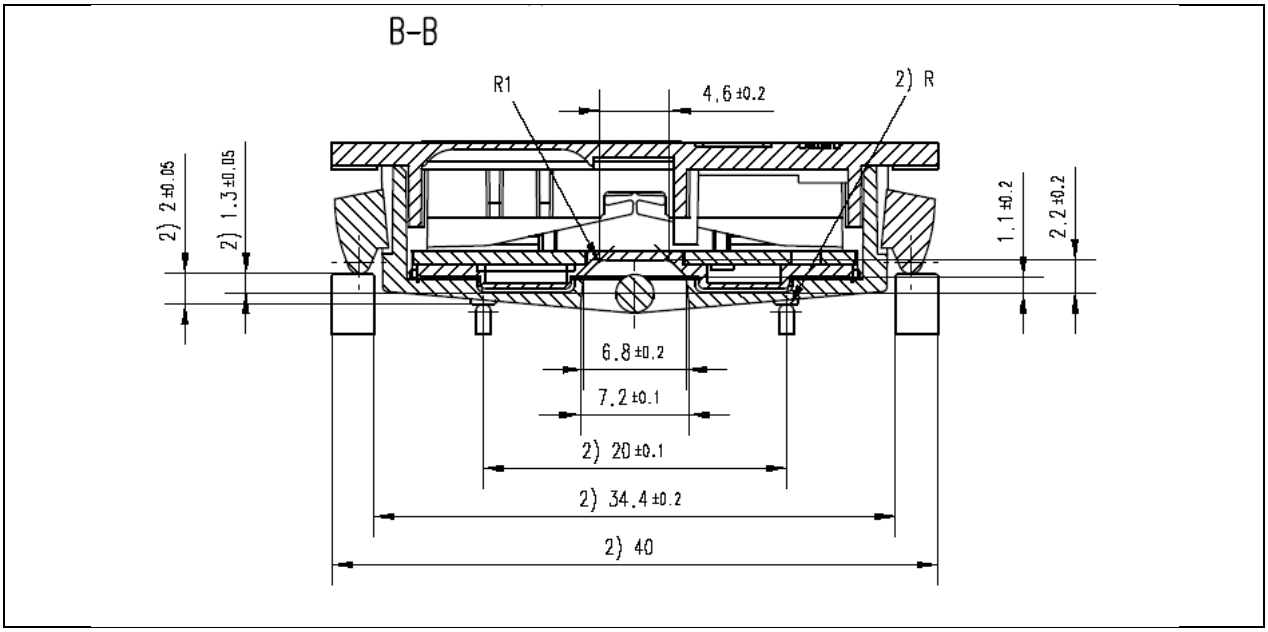
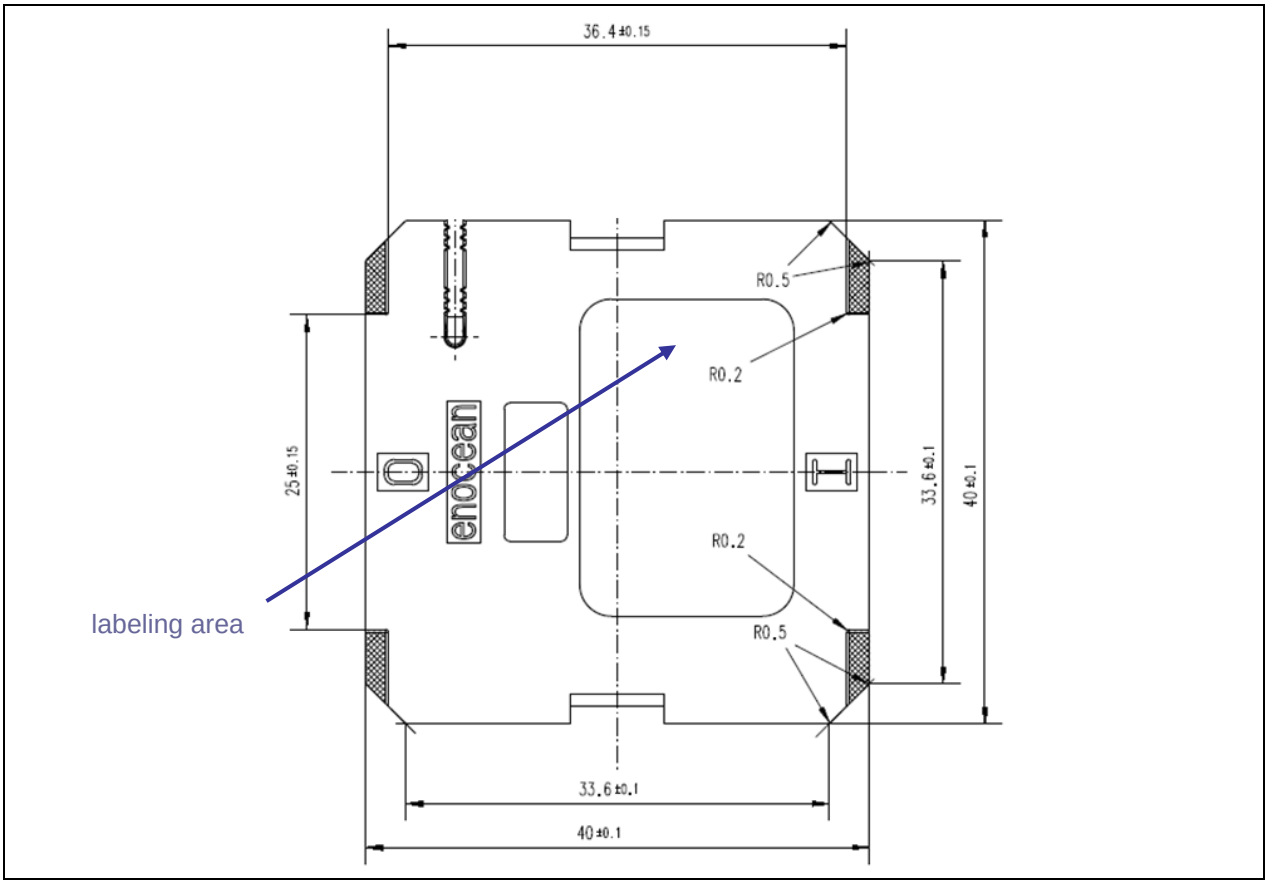


PTM 21x, cut A



2) dimensions of rocker part

PTM 21x, cut B and C



Hatched areas: support planes

PTM 21x rear view

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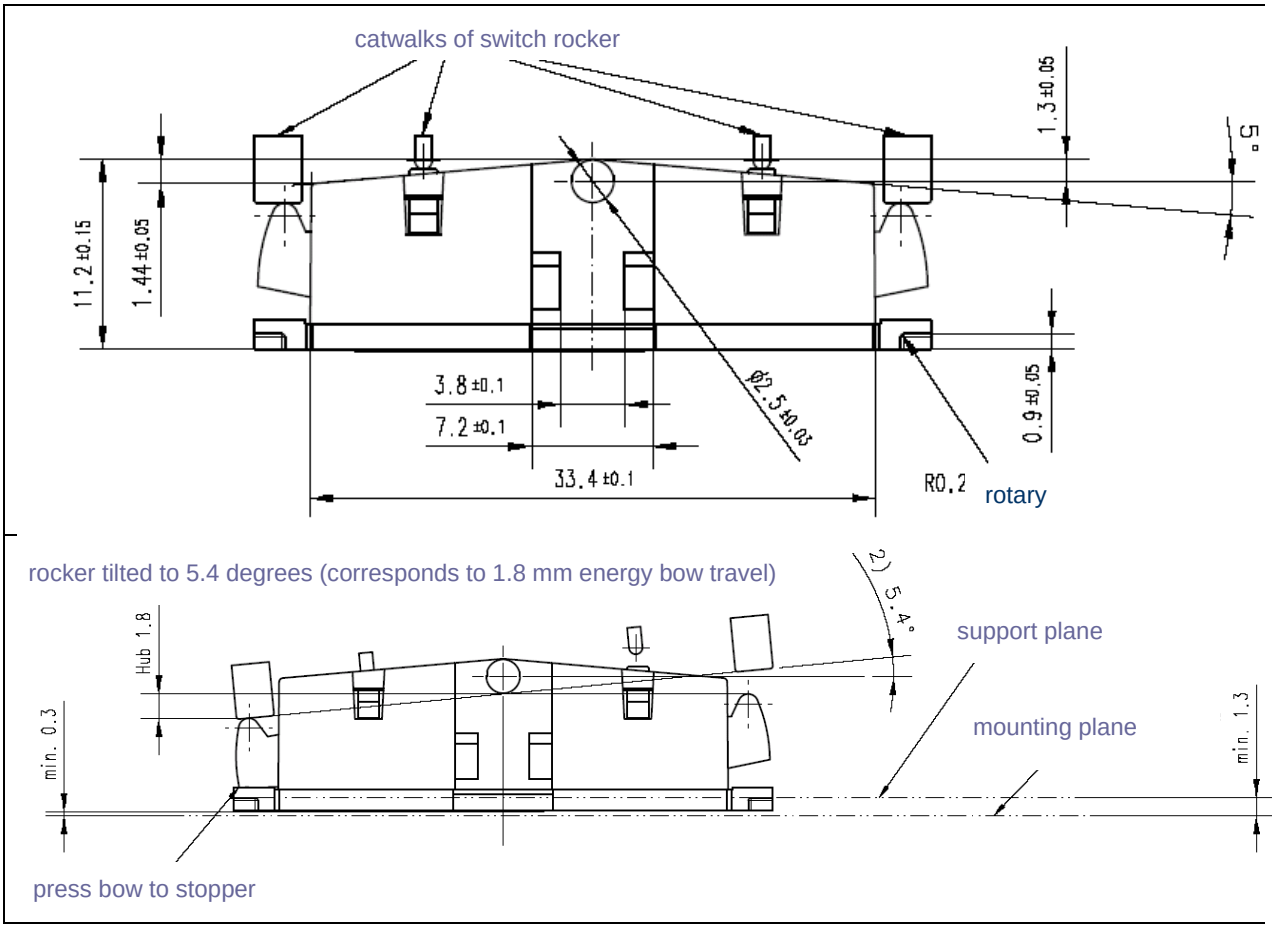

2) dimensions of rocker part

PTM 21x, side view

If the rocker is not mounted on the rotation axis of PTM 21x several tolerances have to be considered! The measure from support plane to top of the energy bow is 7.70 mm +/- 0.3 mm!

The movement of the energy bow must not be limited by mounted rockers!

Catwalks of switch rocker must not exert continuous forces on contact nipples!

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1.5 Environmental Conditions

Operating temperature	-25 °C up to +65 °C
Storage temperature	-25 °C up to +65 °C
Humidity	0% to 95% r.h.

1.6 Ordering Information

Type	Ordering Code	Approvals
PTM 210	**S3001-A210**	**CE, R&TTE, EN 300220**
PTM 215	**S3001-A215**	**CE, R&TTE, EN 300220**
PTM 210U	**S3031-A210**	**FCC: Part 15.231** **IC: RSS-210**
PTM 210J	**S3061-A210**	**MIC: ARIB STD-T108**

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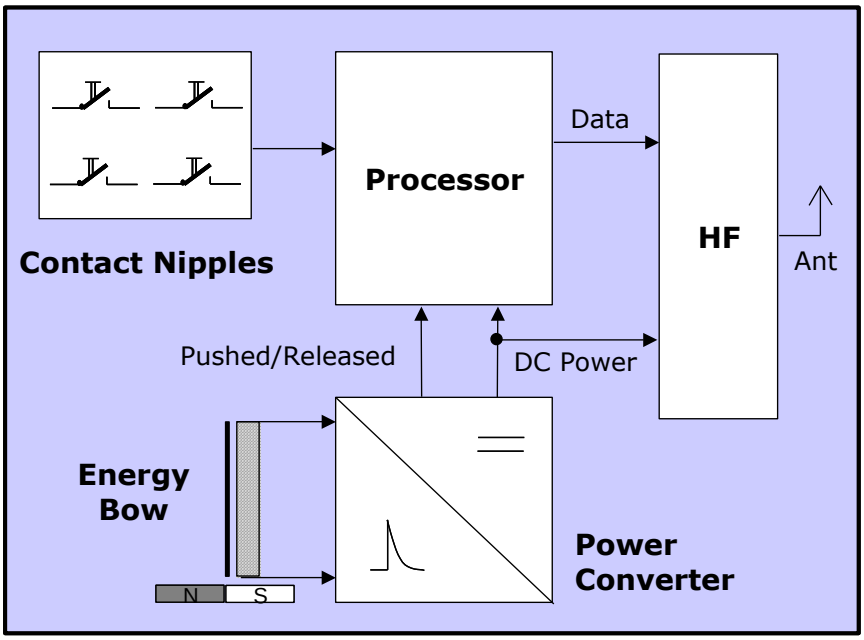
2 FUNCTIONAL DESCRIPTION

2.1 Block Diagram



Block diagram of PTM 21x

Energy Bow / Power Generator
Converts pressure on the energy bow into electrical energy.

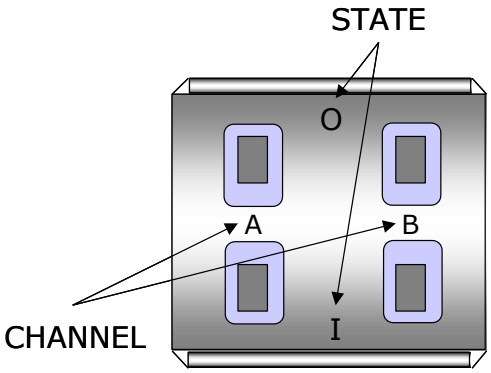
Power Converter
Electronic converter unit for generating the device DC power supply

Processor
Converts the contact nipples' status and pushed/released data from the power generator into a reliable and energy-efficient telegram structure.

Radio transmitter
Sends the data in the form of a series of short EnOcean radio telegrams.

2.2 Contact Nipples Designation

With 4 contact nipples, the PTM 21x offers 2 channels with 4 action states each (upper/lower nipple is pressed/released when activating the energy bow). The nipples' designation is as follows:



Contact nipple designation

2.3 Operating modes

There are 2 operating modes:

- Normal mode: PTM 210, PTM 210U, PTM 210J and PTM 215
- Secure mode: PTM 215

After production, PTM 215 is set to "normal mode".

Radio signals of the PTM 21x are event-controlled (energy bow is pressed/released) with contact nipple code (channel/state) and unique device identification (fixed 32-bit ID).

2.3.1 Normal mode (PTM 210, PTM 210U, PTM 210J, PTM 215)

In normal mode, PTM 21x sends telegrams according to EEP F6-02-xx and F6-04-xx as specified in EnOcean Equipment Profiles V2.5. Details see:
http://www.enocean-alliance.org/eep/

Due to the mechanical hysteresis of the energy bow, in most rocker switch device implementations, pressing the rocker sends an N-message and releasing the rocker sends a U-message!

2.3.2 Secure mode (PTM 215)

In secure mode, PTM 215 sends telegrams with rolling code as specified in the "Security of EnOcean Radio Networks" specification. When telegrams are not received by the receiver this may lead to a de-synchronization of transmitter and receiver. In order to prevent failure, the receiver will usually test if the rolling code is in a defined window and will resynchronize automatically. The size of this rolling code window is set on the receiver side.

The teach-in telegram is described in chapter 4.2 of "Security of EnOcean Radio Networks".
Type is: 1-PTM
It is sent by simultaneously pressing both contact nipples of rocker A or rocker B and actuating the energy bow. See also 2.3.3.

In operating mode the telegram structure is as follows:

R-ORG-S 8 bit	DATA 8 bit	MAC 24 bit	ID 32 bit	STATUS 8 bit

R-ORG-S : 0x30
DATA : This field is encrypted. After decryption with VAES decryption algorithm DATA can be interpreted as shown in the table below.
The VAES decryption algorithm is described in the "Security of EnOcean Radio Networks" specification.
http://www.enocean.com/en/security-specification/
DolphinAPI provides functions for this purpose
MAC : Message authentication code as described in the "Security of EnOcean Radio Networks" specification.
http://www.enocean.com/en/security-specification/
In order to verify if a telegram is valid the receiver has to calculate the MAC based on R-ORG-S, encrypted DATA and current rolling code and compare it with the received MAC value.
DolphinAPI provides functions for this calculation.
ID : Unique 32 bit identifier
STATUS : always 0

DATA after decryption with VAES	Description
0x00-0x04	Reserved
0x05	Key A1 and B0 pressed. Polarity PUSH
0x06	3 or 4 keys pressed
0x07	Key A0 and B0 pressed. Polarity PUSH
0x08	No key pressed. Polarity PUSH
0x09	Key A1 and B1 pressed. Polarity PUSH
0x0A	Key A0 and B1 pressed. Polarity PUSH
0x0B	Key B1 pressed. Polarity PUSH
0x0C	Key B0 pressed. Polarity PUSH
0x0D	Key A1 pressed. Polarity PUSH
0x0E	Key A0 pressed. Polarity PUSH
0x0F	Polarity RELEASE for any combination of keys pressed

The rolling code is not transmitted with every telegram. It is only transmitted during teach-in. Afterwards the receiver has to increase the counter autonomously.

It is strongly recommended to use PTM 215 in secure mode only in fixed installations with safe radio distance. Otherwise it could happen that the rolling code of PTM 215 and the receiver get out of synchronization.
Failure will occur when PTM 215 is operated consecutively outside the range of the receiver more often than the defined rolling code window allows. The same may apply in case of power interruptions on the receiver side. In this case it is necessary to set the receiver in LRN mode and teach-in the device again.

Due to the enhanced telegram length of teach-in telegrams in secure mode, teach-in is only possible at temperatures between 0 and 40°C.

If the teach-in process is not successful please repeat the procedure. Due to the enhanced telegram length of teach-in telegrams in secure mode only a single teach-in sub-telegram is sent at every actuation (no redundancy).

2.3.3 Switching between modes

The device can be switched from normal mode to secure mode by simultaneously pressing both contact nipples of rocker A or rocker B and actuating the energy bow.

The device can be switched from secure mode to normal mode by simultaneously pressing all four contact nipples of rocker A and rocker B and actuating the energy bow.

Before changing the operating mode please make sure to clear the device from all receivers which have been taught to work with this device before. Otherwise the receiver will ignore the telegrams and the application will not work.

3 APPLICATIONS INFORMATION

3.1 Construction of application specific Switch Rockers

For CAD system development support, 3D construction data is available from EnOcean (IGS data). Using this data, the mechanical interface is fixed, and the shape and surface of the rocker(s) can be changed according to requirements. Recommendation for suitable rocker material is polycarbonate (buckling resistant and wear-proof material). It is recommended to apply teflon varnish in the areas of actuation.

Please note that the rockers should be of nonmetal for best transmission range! Please also avoid plastic materials with conducting ingredients like graphite!

3.2 Device Mounting

For mounting the PTM 21x device into an application specific case, the package outline drawings of the device are roughly dimensioned in chapter 1.4. If more detailed dimensioning data device case is necessary, 3D construction data is available from EnOcean (IGS data).

Mounting the device back side on metal surfaces directly or mounting the device into metal frames can lead to up to typical 30% loss of transmission range within a building.

3.3 Transmission Range

The main factors that influence the system transmission range are type and location of the antennas of the receiver and the transmitter, type of terrain and degree of obstruction of the link path, sources of interference affecting the receiver, and "dead" spots caused by signal reflections from nearby conductive objects. Since the expected transmission range strongly depends on this system conditions, range tests should categorically be performed before notification of a particular range that will be attainable by a certain application.

The following figures for expected transmission range are considered by using a PTM, a STM or a TCM radio transmitter device and the TCM radio receiver device with preinstalled whip antenna and may be used as a rough guide only:

Line-of-sight connections: Typically 30 m range in corridors, up to 100 m in halls
Plasterboard walls / dry wood: Typically 30 m range, through max. 5 walls
Line-of-sight connections: Typically 30 m range in corridors, up to 100 m in halls
Ferro concrete walls / ceilings: Typically 10 m range, through max. 1 ceiling
Fire-safety walls, elevator shafts, staircases and supply areas should be considered as screening.

The angle at which the transmitted signal hits the wall is very important. The effective wall thickness – and with it the signal attenuation – varies according to this angle. Signals should be transmitted as directly as possible through the wall. Wall niches should be avoided. Other factors restricting transmission range:

Switch mounted on metal surfaces (up to 30% loss of transmission range)
Hollow lightweight walls filled with insulating wool on metal foil
False ceilings with panels of metal or carbon fibre
Lead glass or glass with metal coating, steel furniture

The distance between EnOcean receivers and other transmitting devices such as computers, audio and video equipment that also emit high-frequency signals should be at least 0.5 m.

A summarized application note to determine the transmission range within buildings is available as download from www.enocean.com.

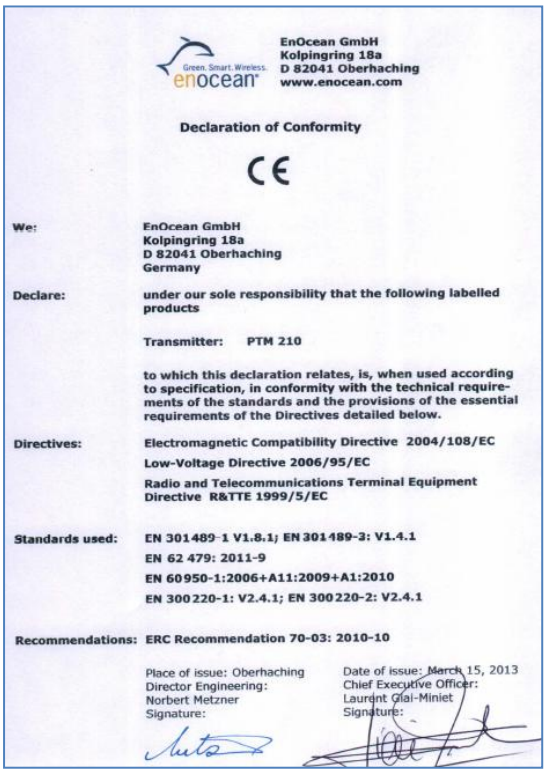
4 AGENCY APPROVALS

4.1 PTM 210 and PTM 215: CE Approval for the European Market

The devices bear the EC conformity marking CE and conform to the R&TTE EU-directive on radio equipment. The assembly conforms to the European and national requirements of electromagnetic compatibility. The conformity has been proven and the corresponding documentation has been deposited at EnOcean. The PTM devices can be operated without notification and free of charge in the area of the European Union, and in Switzerland. The following provisos apply:

- EnOcean RF devices must not be modified or used outside their specification limits.
- EnOcean RF devices may only be used to transfer digital or digitized data. Analog speech and/or music are not permitted.
- The final product incorporating EnOcean RF devices must itself meet the essential requirement of the R&TTE Directive and a CE marking must be affixed on the final product and on the sales packaging each. Operating instructions containing a Declaration of Conformity has to be attached.

If transmitters are used according to the regulations of the 868.300 MHz band, a so-called "Duty Cycle" of 1% per hour for each transmitter must not be exceeded. Permanent transmitters such as radio earphones are not allowed. For conventional applications, it must be ensured that the PTM 215 or PTM 210 radio device is not operated more than 6000 times within one hour (one operation: energy bow is pressed and released). Within this calculation, the extraordinary short telegram length is considered including three subtelegrams. Also a tolerance of 5% in the telegram length is included.



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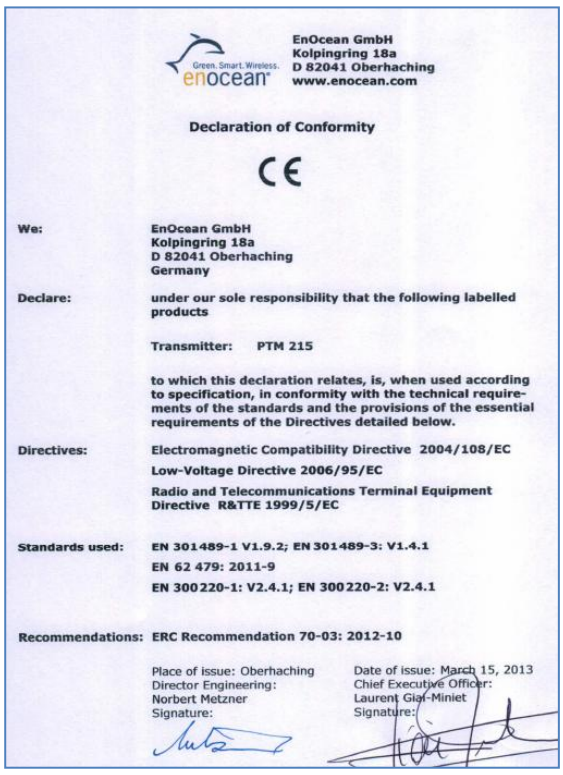
Declaration of Conformity

CE

We:	EnOcean GmbH Kolpingring 18a D 82041 Oberhaching Germany
Declare:	under our sole responsibility that the following labelled products Transmitter: PTM 210 to which this declaration relates, is, when used according to specification, in conformity with the technical requirements of the standards and the provisions of the essential requirements of the Directives detailed below.
Directives:	Electromagnetic Compatibility Directive 2004/108/EC Low-Voltage Directive 2006/95/EC Radio and Telecommunications Terminal Equipment Directive R&TTE 1999/5/EC
Standards used:	EN 301489-1 V1.8.1; EN 301489-3: V1.4.1 EN 62 479: 2011-9 EN 60950-1:2006+A11:2009+A1:2010 EN 300220-1: V2.4.1; EN 300220-2: V2.4.1
Recommendations:	ERC Recommendation 70-03: 2010-10

Place of issue: Oberhaching
Director Engineering:
Norbert Metzner
Signature:

Date of issue: March 15, 2013
Chief Executive Officer:
Laurent Glai-Miniet
Signature:



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D 82041 Oberhaching
www.enocean.com

Declaration of Conformity

CE

We:	EnOcean GmbH Kolpingring 18a D 82041 Oberhaching Germany
Declare:	under our sole responsibility that the following labelled products Transmitter: PTM 215 to which this declaration relates, is, when used according to specification, in conformity with the technical requirements of the standards and the provisions of the essential requirements of the Directives detailed below.
Directives:	Electromagnetic Compatibility Directive 2004/108/EC Low-Voltage Directive 2006/95/EC Radio and Telecommunications Terminal Equipment Directive R&TTE 1999/5/EC
Standards used:	EN 301489-1 V1.9.2; EN 301489-3: V1.4.1 EN 62 479: 2011-9 EN 300220-1: V2.4.1; EN 300220-2: V2.4.1
Recommendations:	ERC Recommendation 70-03: 2012-10

Place of issue: Oberhaching
Director Engineering:
Norbert Metzner
Signature:

Date of issue: March 15, 2013
Chief Executive Officer:
Laurent Glai-Miniet
Signature:

4.2 PTM 210U: FCC and Industry Canada Regulatory Statements

This device complies with part 15 of the FCC rules and Industry Canada ICES- 003. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Any changes or modifications not expressly approved by manufacturer could void the user's authority to operate the equipment.

When the product is placed on the US / Canadian market, it must carry the Specified Radio Equipment marking as shown below:

FCC ID:	SZV-PTM210U
IC:	5713A-PTM210U

IMPORTANT! Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, meme si le brouillage est susceptible d'en compromettre le fonctionnement.

IMPORTANT! Tous les changements ou modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actioner cet équipment.

TCB

GRANT OF EQUIPMENT AUTHORIZATION

Certification
Issued Under the Authority of the
Federal Communications Commission
By:

TCB

Timco Engineering, Inc.
849 NW State Road 45
P.O. Box 370,
Newberry, FL 32669

Date of Grant: 01/31/2013
Application Dated: 01/31/2013

EnOcean GmbH
Kolpingring 18a
Oberhaching, 82041
Germany

Attention: Armin Anders , Director Product Marketing

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER: SZV-PTM210U
Name of Grantee: EnOcean GmbH
Equipment Class: Part 15 Security/Remote Control Transmitter
Notes: PUSHBUTTON TRANSMITTER DEVICE

Grant Notes	FCC Rule Parts	Frequency Range (MHZ)	Output Watts	Frequency Tolerance	Emission Designator
	15.231	902.9 - 902.9			

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Newberry, Florida 32669
http://www.timcoengr.com
888.472.2424 F 352.472.2030 email: tei@timcoengr.com

No. > 153IC13

TECHNICAL ACCEPTANCE CERTIFICATE
CERTIFICAT D' ACCEPTABILITÉ TECHNIQUE

CERTIFICATION No. / No. DE CERTIFICATION: > IC: 5713A-PTM210U

ISSUED TO / DÉLIVRÉ A: > EnOcean GmbH, Kolpingring 18a, Oberhaching,, 84021

TESTED BY / TESTÉ A: > Nemko-CCL, Company No: 2041A-2, 1940 W ALEXANDER STREET, SALT LAKE CITY, UTAH 84119, USA, 801-972-6146; 801-972-8432, MERRY.JACKSON@NEMKO.COM, TOM.JACKSON@NEMKO.COM

TYPE OF EQUIPMENT / GENRE DE MATÉRIEL: > LOW POWER DEVICE (902-928 MHz)

MODEL NUMBER / MARQUE ET MODELE: > PTM 210U

FREQUENCY RANGE / BANDE DE FREQUENCES	EMISSION TYPE / GENRE D'EMISSION	R.F. POWER / PUISSANCE H.F.	ANTENNA INFO / INFO SUR L'ANTENNE	SPECIFICATION/ ISSUE & DATE / SPECIFICATION/ EDITION & DATE
902.9-902.9 MHz	266KF1D	N/A	Trace antenna	RSS-210 Issue 8, DEC 10

Note1: This equipment also complies with RSS-102, Issue 4 (March 2010) and RSS-Gen, Issue 3 (Dec 2010)

Certification of equipment means only that the equipment has met the requirements of the above noted specifications. License applications, where applicable to use certified equipment, are acted on accordingly by the issuing office and will depend on the existing radio environment, service and location of operation.

This certificate is issued on condition that the holder complies and will continue to comply with the requirements of the radio standards specifications and procedures issued by Industry Canada.

I hereby attest that the subject equipment was tested and found in compliance with the above-noted specifications.

La certification du matériel signifie seulement que le matériel a satisfait aux exigences de la norme indiquée ci-dessus. Les demandes de licences nécessaires pour l'utilisation du matériel certifié sont traitées en conséquence par le bureau de délivrance et dépendent des conditions radio ambiantes, du service et de l'emplacement d'exploitation.

Le présent certificat est délivré à la condition que le titulaire satisfasse et continue de satisfaire aux exigences et aux procédures d'Industrie Canada.

J'atteste par la présente que le matériel a fait l'objet d'essai et jugé conforme à la spécification ci-dessus.

ISSUED UNDER THE AUTHORITY OF MINISTER OF INDUSTRY
DÉLIVRÉ AVEC L'AUTORISATION DU MINISTRE DES INDUSTRIES

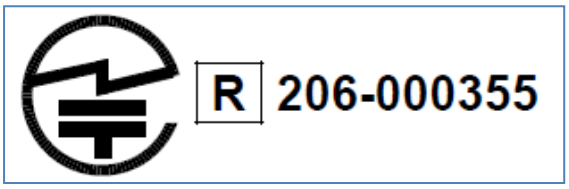
DATE: JANUARY 31, 2013

S. S. Sanders, President

4.3 PTM 210J: Japanese Type Approval

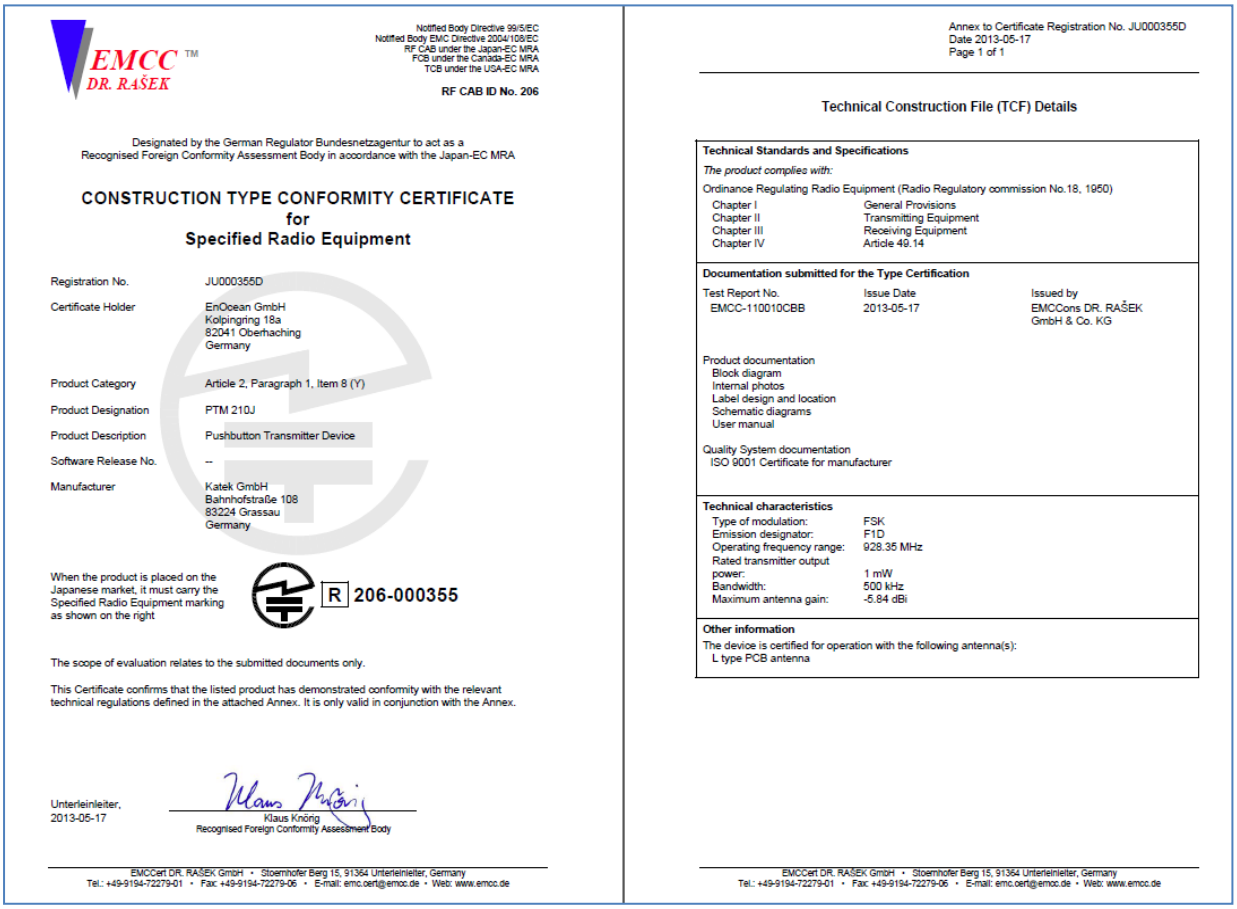
PTM 210J complies with the Japanese radio law and is certified according to ARIB STD-T108 V1.0 (2012-02). There is a certification marking on the back side of the module.

When the product is placed on the Japanese market, it must carry the Specified Radio Equipment marking as shown below:



If the certification label cannot be recognized from outside (e.g. installation in a host) appropriate information must be referenced in the user manual.

Using the key combination A0+A1+B1 (see contact nipples designation), PTM 210J transmits a telegram with 48-bit ID as required by Japanese radio law.



EMCC DR. RAŠEK

Notified Body Directive 99/5/EC
Notified Body EMC Directive 2004/108/EC
RF CAB under the Japan-EC MRA
FCB under the Canada-EC MRA
TCB under the USA-EC MRA

RF CAB ID No. 206

Designated by the German Regulator Bundesnetzagentur to act as a Recognised Foreign Conformity Assessment Body in accordance with the Japan-EC MRA

CONSTRUCTION TYPE CONFORMITY CERTIFICATE for Specified Radio Equipment

Registration No.	JU000355D
Certificate Holder	EnOcean GmbH Kolpingring 18a 82041 Oberhaching Germany
Product Category	Article 2, Paragraph 1, Item 8 (Y)
Product Designation	PTM 210J
Product Description	Pushbutton Transmitter Device
Software Release No.	--
Manufacturer	Katek GmbH Bahnhofstraße 108 83224 Grassau Germany

When the product is placed on the Japanese market, it must carry the Specified Radio Equipment marking as shown on the right

R 206-000355

The scope of evaluation relates to the submitted documents only.

This Certificate confirms that the listed product has demonstrated conformity with the relevant technical regulations defined in the attached Annex. It is only valid in conjunction with the Annex.

Unterleinleiter, 2013-05-17

Klaus Knörig
Recognised Foreign Conformity Assessment Body

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Annex to Certificate Registration No. JU000355D
Date 2013-05-17
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Technical Construction File (TCF) Details

Technical Standards and Specifications

The product complies with:

Ordinance Regulating Radio Equipment (Radio Regulatory commission No.18, 1950)

Chapter I	General Provisions
Chapter II	Transmitting Equipment
Chapter III	Receiving Equipment
Chapter IV	Article 49.14

Documentation submitted for the Type Certification

Test Report No.	Issue Date	Issued by
EMCC-110010CBB	2013-05-17	EMCCons DR. RAŠEK GmbH & Co. KG

Product documentation
- Block diagram
- Internal photos
- Label design and location
- Schematic diagrams
- User manual

Quality System documentation
- ISO 9001 Certificate for manufacturer

Technical characteristics

Type of modulation:	FSK
Emission designator:	F1D
Operating frequency range:	928.35 MHz
Rated transmitter output power:	1 mW
Bandwidth:	500 kHz
Maximum antenna gain:	-5.84 dBi

Other information

The device is certified for operation with the following antenna(s):
- L type PCB antenna

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